User manual

ADA-1040PC1
MODBUS-ASCII to MODBUS-RTU converter

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1. GENERAL INFORMATION

Thank you for your purchase of **CEL-MAR Company** product. This product has been completely tested and is covered by a two year warranty on parts and operation from date of sale.
If any questions or problems arise during installation or use of this product, please do not hesitate to contact Technical Support at +48 41 362-12-46 or e-mail support@cel-mar.pl.

1.1. WARRANTED INFORMATION

ADA-1040PC1 converter is covered by a two year warranty from date of sale. In case of being damaged it will be repair or the damaged component will be replace. The warranty does not cover damage caused from improper use, materials consumption or any unauthorized changes. If the product does not function (is damaged), or not operate in accordance with the instructions, will be repaired or replaced.
All warranty and no warranty repairs must be returned with paid transport and insuring to the **CEL-MAR Company.**
CEL-MAR Company under no circumstances won't be responsible for ensuing damage from improper using the product or as a result of random causes: the lightning discharge, the flood, the fire and the like.
CEL-MAR Company is not be held responsible for damages and loss including: loss of profits, loss of data, pecuniary losses ensuing from using or the impossibility of using this product.
In specific cases **CEL-MAR Company** discontinue all warranties and in particular do not follow the user manual and do not accept terms of warranty by the user.

1.2. GENERAL CONDITIONS FOR SAFE USE

The device should be installed in a safe and stable places (eg, electroinstallation cabinet), the powering cable should be arranged so as not to be exposed to trampling, attaching, or pulling out of the circuit.
Do not put device on the wet surface.
Do not connect devices for nondescript powering sources,
Do not damage or crush powering wires.
Do not make connection with wet hands.
Do not adapt, open or make holes in casings of the device!
Do not immerse device in water or no other liquid.
Do not put the fire opened on device sources: candles, an oil lamps and the like.
Complete disable from the supply network is only after disconnecting the power supply circuit voltage.
Do not carry out the assembly or disassembly of the device if it is enabled. This may result to short circuit and damage the device.

1.3. CE LABEL

CE symbol on organizing the company CEL-MAR a conformity of the device to the directive of the electromagnetic EMC 89/336/EWG compatibility means (Electromagnetic Compatibility Directive). The declaration of the agreement is accessible through the contact with the technical service at the address e-mail: support@cel-mar.pl or on the phone at the +48 41 362-12-46.

1.4. ENVIRONMENTAL PRESERVATION

This sign on the device inform about putting expended device with other waste materials. Device should send to the recycling. (In accordance with the act about the Electronic Appliance Expended from day 29 of July 2005)

1.5. SERVICE AND MAINTENANCE

Converter ADA-1040PC1 does not require the servicing and maintenance.
Technical support is available at number +48 41 362-12-46 in 8.00-16.00, from Monday to Friday or e-mail support@cel-mar.pl.

2. PRODUCT INFORMATION

Converter is delivered with: User Manual, Line terminators 120Ω , CD-ROM with ADAConfig software.

2.1. PROPERTIES

- Conversion of protocols MODBUS-ASCII (RS232) to MODBUS-RTU (RS485/422) and inversely,
- Baud rate and data format conversion between ASCII & RTU converter's ports,
- Operating on 2 or 4 wire buses in RS485/RS422 standard in point-to-point and multipoint mode,
- Conversion TX, RX signals of RS232 standard to RS485/RS422 standard and inversely,
- Operation up to 32 devices on RS485 bus,
- Baud rate set on RS232 & RS485/RS422 interfaces (bps): 300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,
- Data format set on RS232 & RS485/RS422 interfaces: data bit: 5, 6, 7, 8; parity: None, Odd, Even; number of stop bits: 1, 2,
- Power supply 10 - 30 VDC stable min. 2W,
- ~3kV= optoizolation in signal channel between RS232 and RS485/422 interfaces,
- 1kV= or 3kV= galvanic isolation between RS232 & RS485/422 interfaces and power supply (depend on version),
- Implemented short circuit protection and over-voltage protection on RS485 / RS422 network,
- Implemented ESD 15kV surge protector of RS232 interface,
- Connection RS485/RS422 network and power supply via screw terminal block 2.5 mm^2.
- DB-9F connector for cable connection of RS232 interface to PC, controller etc.
- Implemented protection against power supply reverse connection,
- Cover compatible with DIN 43880 standard– mounting in typical electro-installation unit,
- Cover adapt to rail mounting according to DIN35 / TS35 standard,
- Cover dimensions (W x D x H) 53mm x 58mm x 90mm,

2.2. DESCRIPTION

Protocol converter MODBUS-ASCII to MODBUS-RTU ADA-1040PC1 is a device solves a problem of connection RS232 devices (communication MODBUS-ASCII protocol) to multipoint RS-485 bus with devices communicate by MODBUS-ASCII protocol.
Simultaneously, the converter can convert RS232 to RS485/422 standards, with setting of data format. Depending on configurations, can be set baud rate, data bits, parity, number of stop bits. The setting can be different for RS232 and RS485/RS422 port.
The converter does not require power supply from RS232 port and support the asynchronous transmission data with baud rate 230,4 kbps.
ADA-1040PC1 has DB-9F connector for connecting RS232 interface and screw terminal block for connection of RS485/422 network and power supply. The DB-9F connector is DCE type to connecting RS232 interface in use of RS232 extension cable (a typical modem cable) without interleaving of Rx with Tx.
Overvoltage protection was made on base safety diodes and fuses on each RS485/RS422 lines.

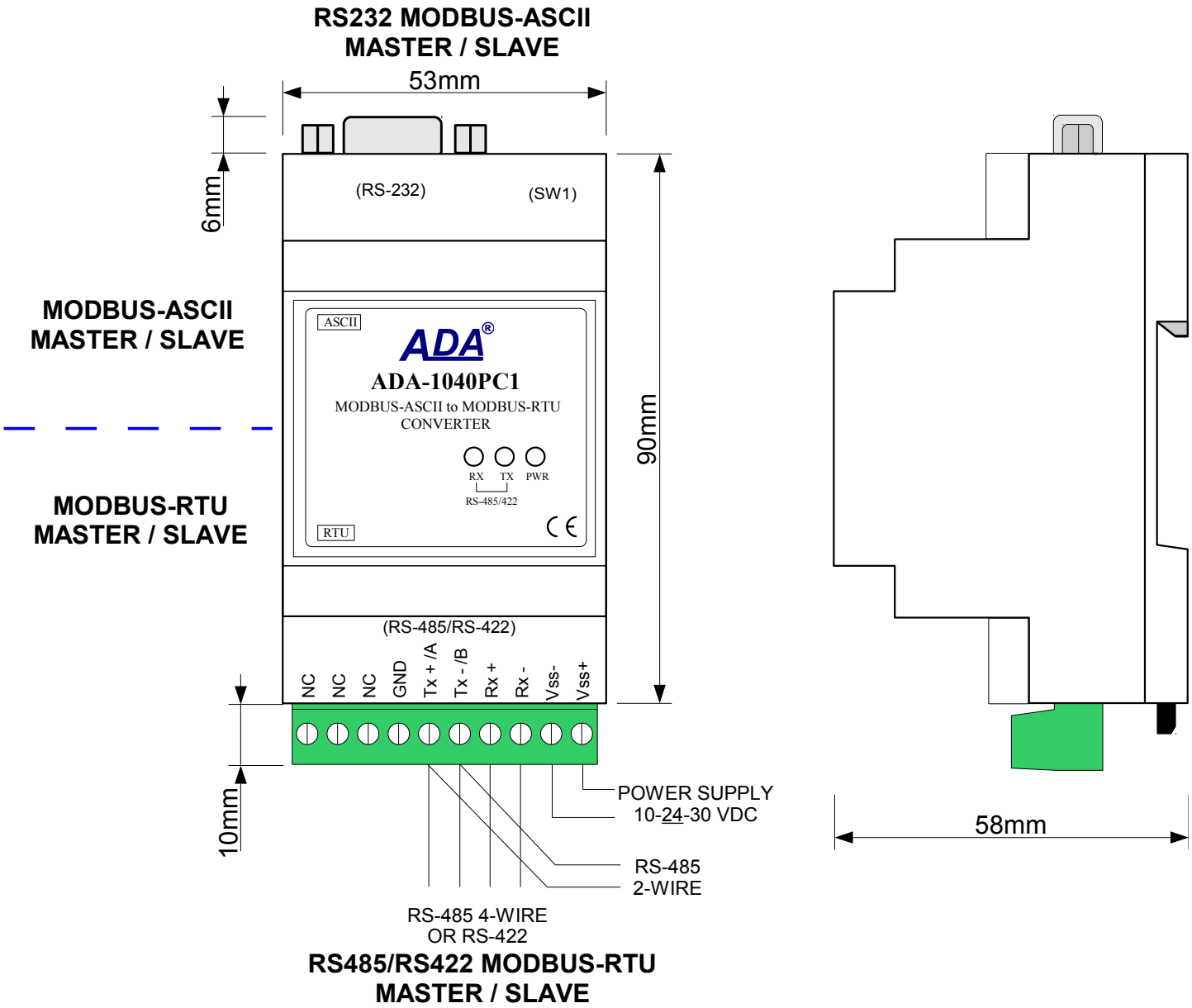


Fig. 1. ADA-1040PC1 view and location of SW1

2.3. ISOLATION

Converter ADA-1040PC1 has 3-way galvanic isolation on the levels 1kV= or 3kV=, depend on version described in section VERSIONS.

3-WAY ISOLATION

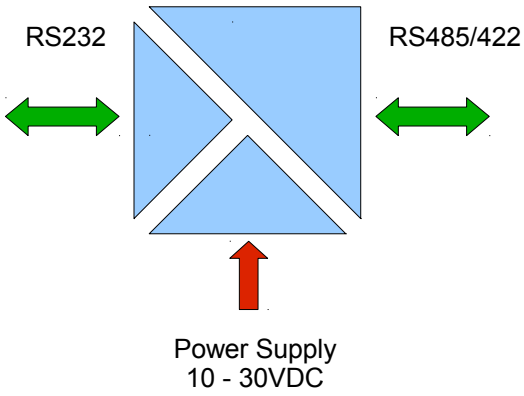


Fig. 2. Isolation structure

3. INSTALLATION

This chapter will show how to use and connect ADA-1040PC1 to RS232, RS485/RS422 network and power supply.
In the purpose of minimization of disruptions from environment is being recommended to:
- apply multipair type shielded cables, which shield can be connected to the earthing on one end of the cable,
- arrange signal cables in the distance not shorter than 25 cm from powering cables.
- apply cable of adequate cross-section due to voltage drops for converter powering,
- use suppression filters for powering converters that are installed within a single object.
- not supply converter from power circuit device that generates large impulse interference such as transmitters, contactors.

3.1. ASSEMBLING

The cover of ADA-1040PC1 converter is adapted to assembly on TS-35 (DIN35) rail. To install the converter, should be mounted on the rail upper part of the cover then press bottom part to hear characteristic „Click” sound.

3.2. CONNECTION TO COMPUTER OR RS232 PORT DEVICE

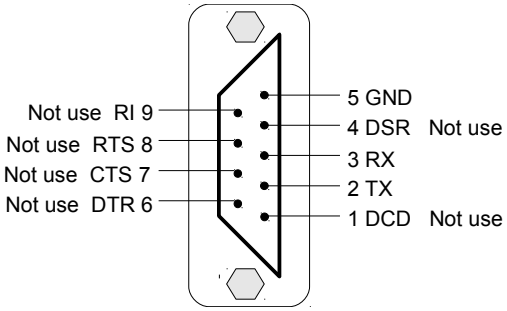


Fig. 3. RS232 interface signals of DB-9F (female) connector.

In case of connection ADA-1040PC1 converter to:
- RS232 port of computer or device, should make a cable accordance to Fig.4
- USB port of computer, should have additional converter USB to RS232 (ADA-I9110 or ADA-I9111), which connect to RS232 port of ADA-1040PC1, like on the Fig.5.

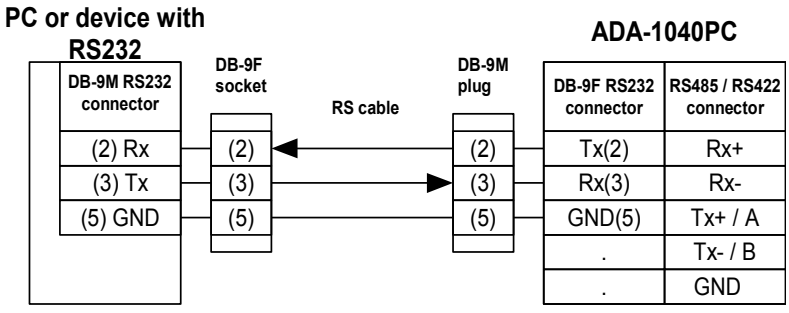
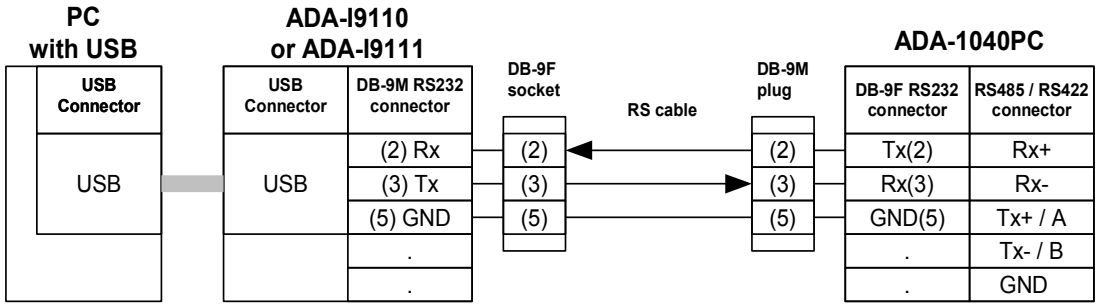


Fig.4. ADA-1040PC1 connection to PC or device with RS232 by the use of cable

Fig. 5. ADA-1040PC1 connection to Pc by the use of USB to RS232 converter ADA-I9110/ADA-I9111



3.3. RS485 NETWORK CONNECTION

RS485/RS422 interface in ADA-1040PC1 converter is available on screw terminal block and is described as: Tx+/A, Tx-/B, Rx+, Rx-. Connection of ADA-1040PC1 to RS485(4W) and RS485(2W) network are shown bellow.

3.3.1. CONNECTION OF MASTER & SLAVE DEVICE MODBUS-ASCII TO RS485(4W) BUS MODBUS-RTU

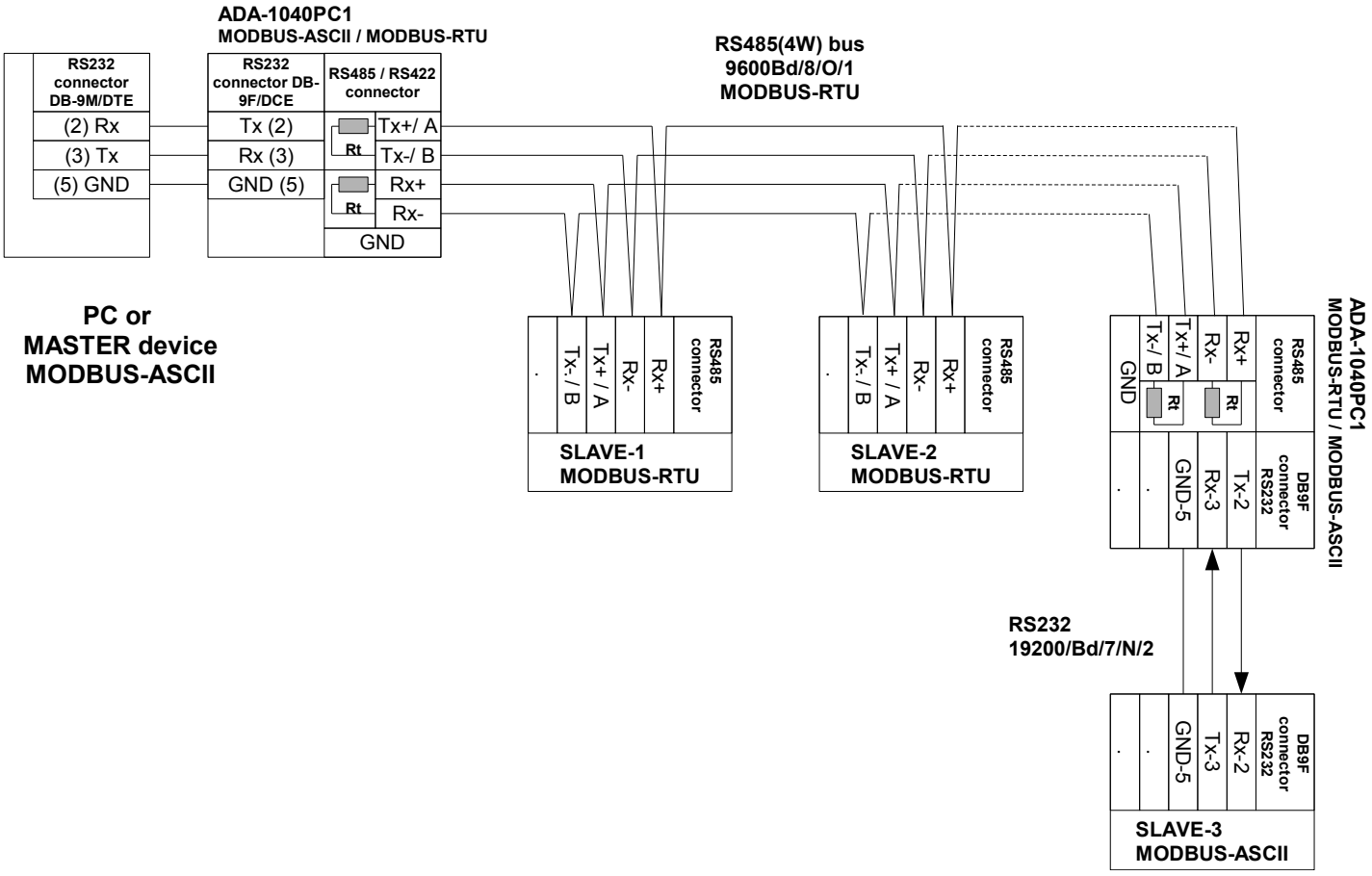


Fig.6. Example connection of ADA-1040PC1 to RS485(4W) 4-wire bus and galvanic separation of SLAVE device

3.3.2. CONNECTION OF MASTER & SLAVE DEVICE MODBUS-ASCII TO RS485(2W) BUS MODBUS-RTU

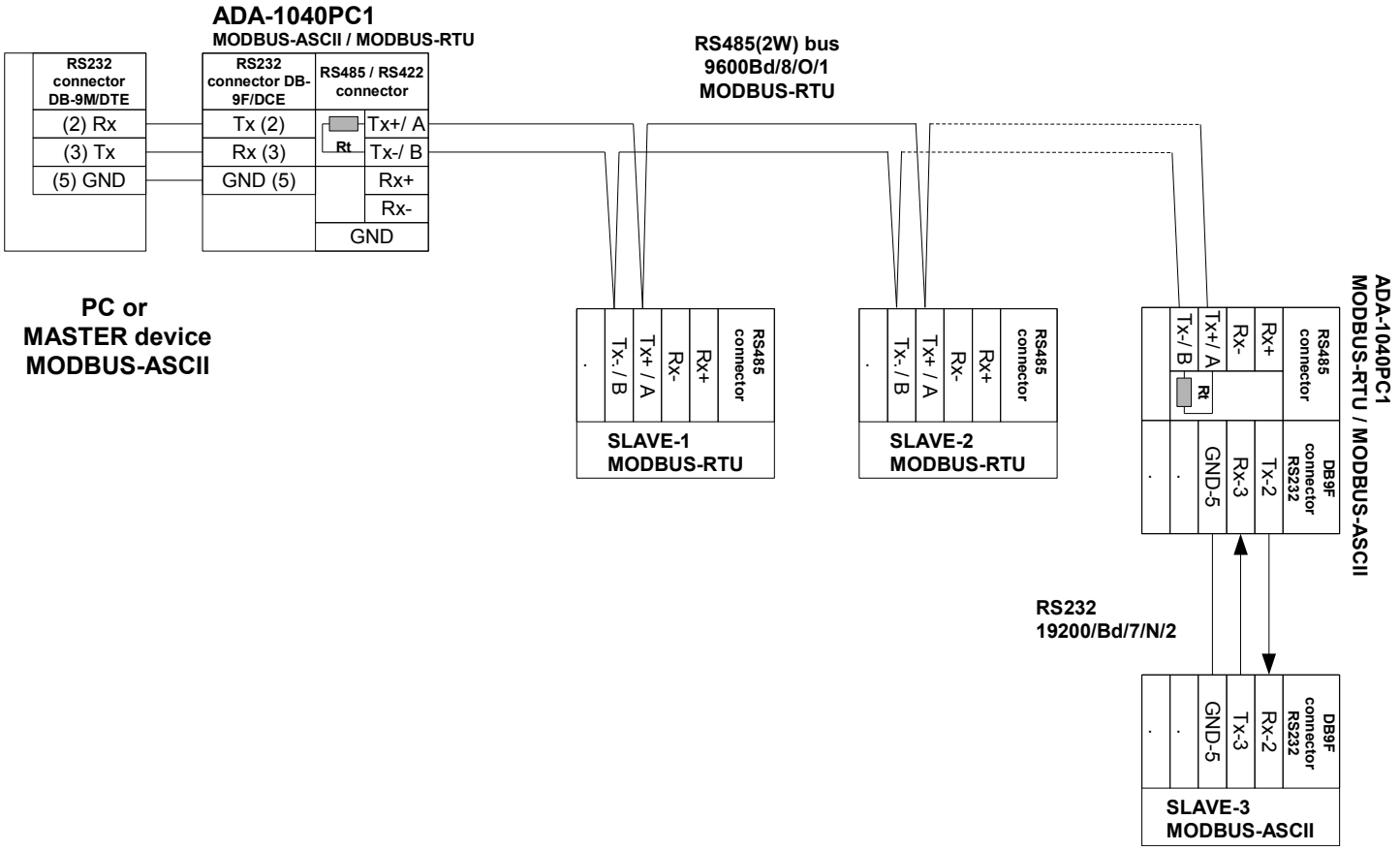


Fig.7. Example connection of ADA-1040PC1 to RS485(2W) 2-wire bus and galvanic separation of SLAVE device

3.3.3. LINE TERMINATION Rt

The application of Line Termination (terminator) Rt = 120 ohms will reduce electrical reflection in data line at high baud rate. It is not needed below 9600Bd. Should be used the Line Termination resistor if the distance is over 1000m @ 9600Bd or 700m @ 19200Bd, and if the disturbance in transmission will appear.
Example connection of Rt are shown on Fig. 6 & 7. Four Rt=120 Ω , 5%, 0,25W are delivered with the converters.

3.3.4. CONNECTION OF RS232 INTERFACE DEVICES

Connection of SLAVE devices with RS232 interface to ADA-1040PC1 are shown on fig. 6 and fig. 7.

3.4. POWER SUPPLY CONNECTION

To connect power supply to the converter, should have DC power supplies (regulated) output voltage from 10 V= to 30V=, min. nominal power 2W, e.g. ZS-12/250. Power cable from DC power supplies to device can not be longer than 3m.
Should connect positive (+) end of DC power supplies to V+ device terminal and negative (-) end to V- on terminal block. ADA-1040PC1 has protection against power supply reverse connection.

4. ACIVATION

The converter can be power on after properly connection according to section above.
If after connection power supply on front panel will not light green led PWR, check correctness of power supply connecting (polarization). When data is present the LEDs Tx and Rx should blink.

ATTENTION!
AT BAUD RATE ABOVE 38.4 KBPS THE LED'S TX, RX WILL LIGHT WEAKLY DURING DATA TRANSMISSION

4.1. DESCRIPTION OF SIGNALLING LEDS

LED	*Description*
PWR	Signalling of Power Supply
RX	Signalling of data receiving through ADA-1040PC1 from RS485/RS422 port – MODBUS-RTU
TX	Signalling of data transmitting from ADA-1040PC1 through RS485/RS422 port – MODBUS-RTU
Yellow LED by SW1	Not light – signalling of normal operating mode (RUN)
	Blinking at frequency 1 Hz - signalling of configuration mode or data flow of software to the converter.
	Blinking at frequency 2 Hz - signalling of factory default mode
	Lit continuously – signalling of emergency firmware update

4.2. TROUBLESHOOTING

Problem	Solutions
PWR LED is not light	Check polarization and parameters of connected power supply.
Rx LED lights continuously	RS485(4W) /422 network. Wrong polarization on terminals: Rx+, Rx-; change polarization.
No transmission Tx LED is blinking	RS485(4W) / RS422 network. Check correctness of connection to terminals Tx, Rx; according to point 3 and the converter configuration.

5. CONFIGURATION

5.1. OPERATION MODE

The ADA-1040PC1 converter can operates in a few modes :
- RUN mode,
- configuration mode,
- factory default
- emergency firmware update mode,

Those modes can be set by use SW1 located by DB-9F connector, labelled as RS232. To set the switch section, should remove the cover marked as SW1 and make the appropriate settings by the use a small, flat screwdriver.
All available adjusting the SW1 switch are shown in table below.
Converter operation modes

SW1- 1	*SW1- 2*	*Mode*
OFF	OFF	Run
ON	OFF	Configuration
OFF	ON	Factory default
ON	ON	Emergency firmware update

5.2. CONFIGURATION BY USING ADACONFIG

The configuration of ADA-1040PC1 converter can be made by the use of *ADAConfig* Software - selling with converter.
To make the configuration, connect converter to computer and power supply. If after power, on the front panel is not lit green LED PWR, check the power connection (polarity). If the PWR LED lights, set the section of SW1 switch to configuration mode as in table below.

SW1-1	*SW1-2*
ON	OFF

In the configuration mode the yellow LED located by SW1 micro-switch will blink with frequency 1 Hz. Start the ADAConfig Software and make the configuration of transmission parameters for each converter interfaces. First, should be set the number of COM port for communication with the converter, then readout the configuration from ADA-1040PC1 memory using the button ***[Read converter configuration]*** and make the proper changes of each interfaces setting, as below:
– baud rate (kbps): 0.3, 0.6, 1.2, 1.8, 2.4, 4.8, 7.2, 9.6, 14.4, 19.2, 28.8, 38.4, 57.6, 76.8, 115.2, 230.4,
– number of data bites: 5, 6, 7, 8,
– control parity: no control, parity control, control of none parity,
– number of stop bits : 1, 2,
– frame spacing – range from 4 to 255 (time silence as frame's end),
– data flow control – not available yet.

After configuration, the setting should be saved on converter memory by using button ***[Write converter configuration].***
Return to work in run mode is made by using SW1 switch as below.

SW1-1	*SW1-2*
OFF	OFF

In the run mode the yellow LED (located near the SW1), will turn off.

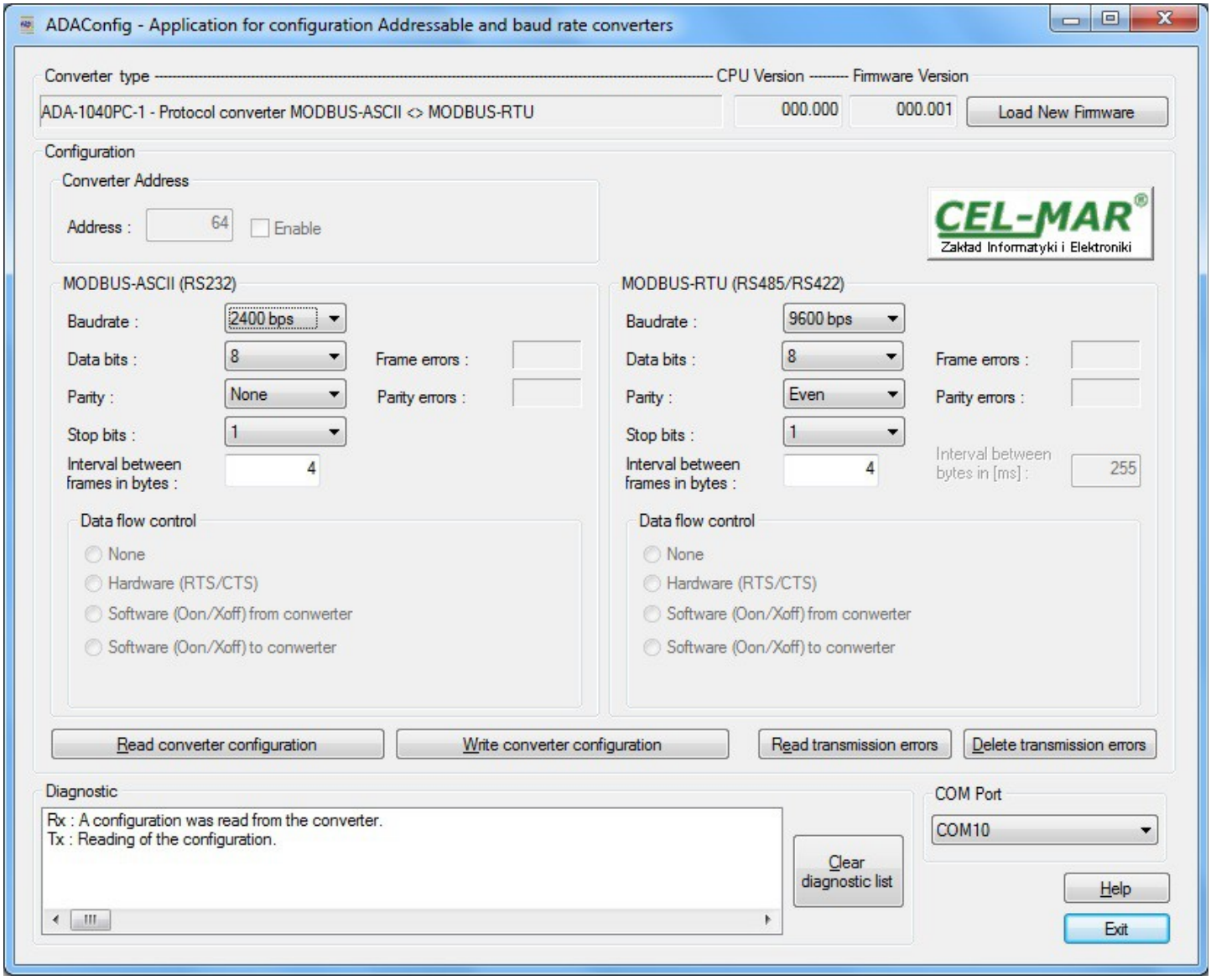


Fig. 8. View of ADAConfig software interface

5.3. FACTORY DEFAULT

In case of faulty functioning ADA-1040PC1, can be restored the factory default setting of the converter internal registers.
Set SW1 microswitch mode as in the table below.

SW1-1	***SW1-2***
OFF	ON

Disconnect the power and after while connect again the power. After that, will be loaded the factory default setting to the converter internal registers.
After this operation, the converter parameters should be set again for operating in the application.
Set micro switch SW1 to run mode as shown in the table below.

SW1-1	***SW1-2***
OFF	OFF

In the run mode the yellow LED (located near the SW1), will turn off.

5.4. FIRMWARE UPDATE

Set SW1 micro switch to configuration mode as in table below.

SW1-1	***SW1-2***
ON	OFF

In the configuration mode the yellow LED will blink with frequency 1Hz. Press a button ***[Load New Firmware]*** to change the software delivered by manufacturer. The Select File window will open (fig. below) and select the *.bin file then click ***[Open]*** - software will be load to *ADAConfig* buffer storage and will be checked. If the *ADAConfig* not detect errors in loaded file, change converter software. Process of updating is visualized by *ADAConfig* in use Progress Window and after proper changing confirmed by correct message.

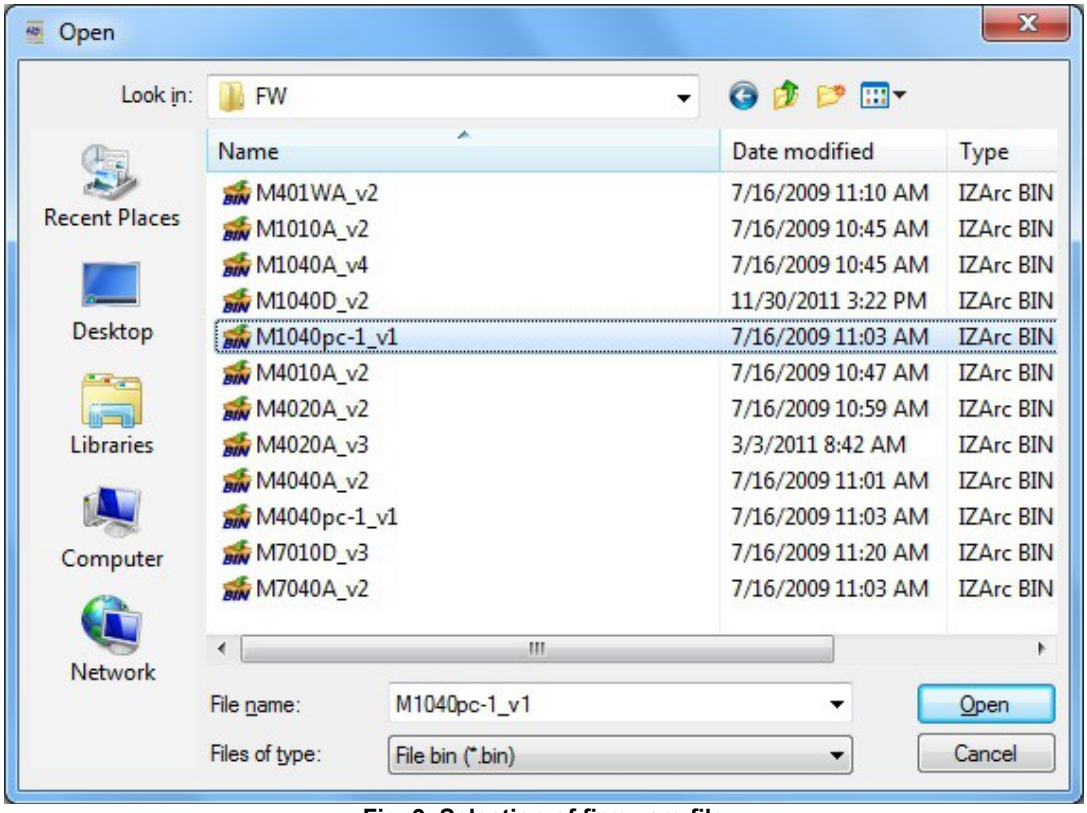


Fig. 9. Selection of firmware file

During loading software the yellow LED located beside SW1 micro-switch will blink, showing data flow to the converter. If the software was loaded correctly yellow LED will be blink with frequency 1 Hz.
After that, set microswitch SW1 to run mode as shown in the table below.

SW1-1	***SW1-2***
OFF	OFF

In the run mode the yellow LED (located near the SW1), will turn off.

5.5. EMERGENCY FIRMWARE UPDATE

In case of the unsuccessful update of the converter software, try again according to description in the above point. If the update is still incorrect use emergency firmware update. Set SW1 microswitch mode as in the table below.

SW1-1	***SW1-2***
ON	ON

After microswitch setting, should be restarted ADA-1040PC1, by turning OFF and then ON the power supply. The yellow LED will light continuously and the converter will be in Emergency Firmware Update mode. Now follow the description in the above point.
After successful software update, set microswitch SW1 to the run mode as shown in the table below.

SW1-1	***SW1-2***
OFF	OFF

In the run mode the yellow LED (located near the SW1), will turn off.

6. DATA TRANSMISSION DIAGNOSTICS

To readout diagnostics, the SW1 microswitch should be set to the configuration mode.

SW1-1	***SW1-2***
ON	OFF

In the configuration mode the yellow LED will blink with frequency 1Hz.
Correctness of transmission proceed on ASCII (RS232) and RTU (RS485) interfaces can be checked by readout the errors list by *ADAConfig* Software from the converter memory. Frames error counter will be increased, in case of: improper speed set compared to real speed of data transmission. Parity error counter will be count the errors which can arise in case of misrepresent bytes in transmitted sign. This counter will not work in case of disable control parity
To check those counters press the button ***[Read transmission errors],*** and to delete (zeroing of counters in the memory of the converter) press ***[Delete transmission errors].*** In case of parity errors or frame errors, should be checked the ADA-1040PC1 converter's configuration and correctness connection of RS485 bus and RS232 device to converter ports.
After finishing the diagnostics, the SW1 microswitch should be set to the run mode as shown in the table below.

SW1-1	***SW1-2***
OFF	OFF

In the run mode the yellow LED (located near the SW1), will turn off.

7. OPERATION

ADA-1040PC1 is bidirectional protocol converter of MODBUS-ASCII MASTER/SLAVE to MODBUS-RTU MASTER/SLAVE, with possibility of conversion a baud rate, a data format (number of data bits, parity bit, stop bits) and interface type (RS232 to RS485/422). Additionally, is a separator of RS232 (MODBUS-ASCII) port to RS485/422 (MODBUS-RTU) port.
If connect to RS232 port a MASTER device (MODBUS-ASCII), should connect to RS485/RS422 port a SLAVE device (MODBUS-RTU). However, if connect to RS232 port a SLAVE device (MODBUS-ASCII), should connect to RS485/422 port a RS485/RS422 bus, on which work MASTER device (MODBUS-RTU).
Frames of MODBUS protocol having the errors CRC / LRC are rejected by the converter.

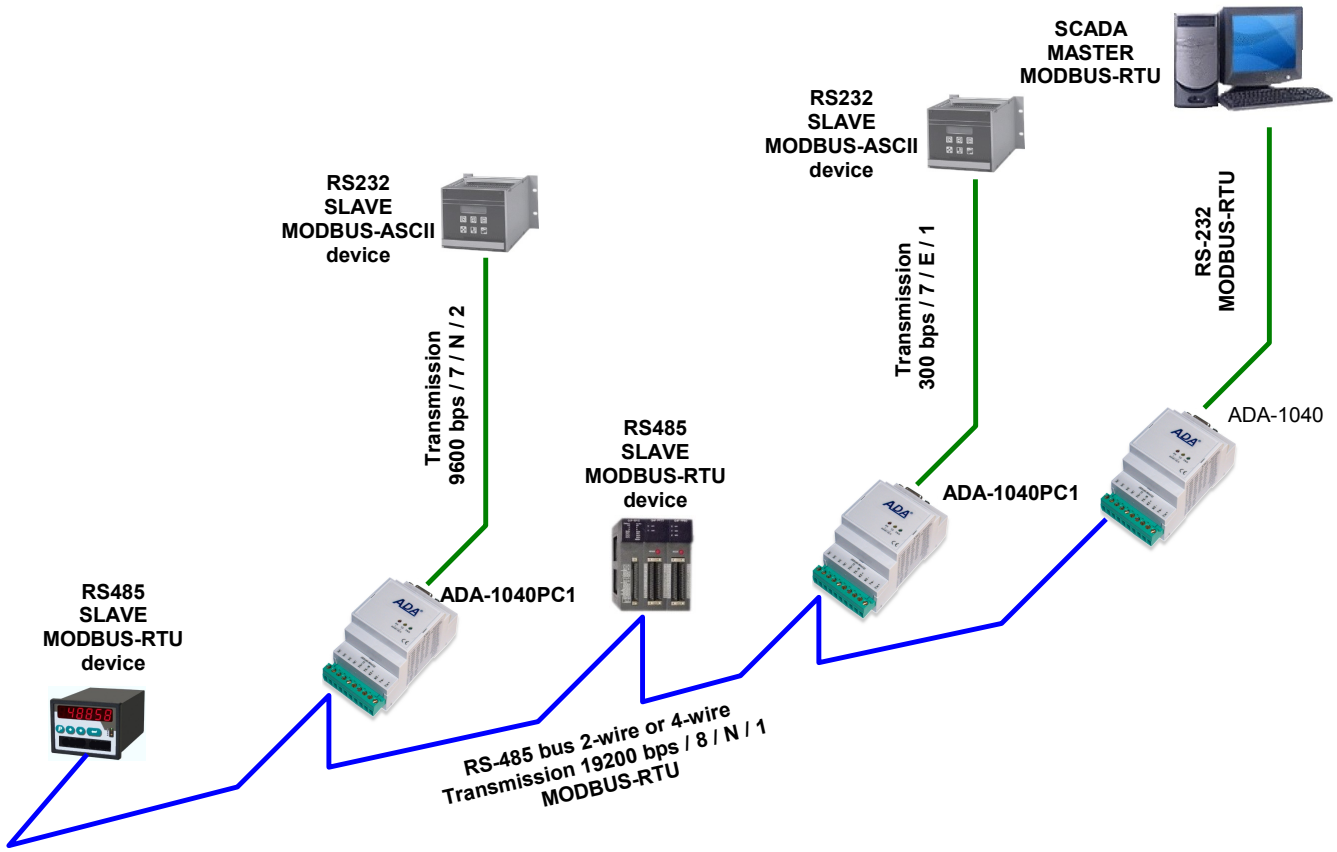


Fig. 10. Connection of MODBUS-ASCII devices to RS485 MODBUS-RTU bus

8. RS232 INTERFACE – PIN DESCRIPTION OF DSUB-9F-DCE SOCKET

Pin	Signal	Description	ADA-1040PC1
1	(DCD)	Level of receiver signal	Connected with DSR
2	(TxD)	Data transmission from ADA-1040PC1	Transmitter
3	(RxD)	Data receiving via ADA-1040PC1	Receiver
4	(DSR)	Readiness of data receiving/ transmission	Connected with DTR
5	(SG)	Signal ground	GND
6	(DTR)	Readiness of data receiving/ transmission	Connected with DSR
7	(CTS)	Device confirms receiving RTS signal from ADA-1040PC1	Connected with RTS
8	(RTS)	Device reports readiness to receive data	Connected with CTS
9	(RI)	Call rate	Not connected

9. VERSIONS

ADA-1040PC1 - ☐ - ☐

Version:	
Standard	**1**
3-way galvanic isolation:	
reserved	**1**
1kV=	**23**
3kV=	**33**

Order example:
Product Symbol: **ADA-1040PC1-1-23**
1 – standard version,
23 – 1kV=, 3-way galvanic isolation,

10. SPECIFICATION

Transition Parameters		
Interface	**RS-232 (ASCII)**	**RS-485/RS-422 (RTU)**
Connector	DSUB-9 socket, female	Screw terminal, wire max. Ø 2,5mm^2
Line length	up to 15m	1200m
Max. number of connected device	1	32
Transmission line	DB9F/DB9M cable, multicore 9x0,34 shielded (up to 15m)	Twisted cable 1-pair or 2-pair , UTP Nx2x0,5 (24AWG), shield inside large interferences STP Nx2x0,5(24AWG)
Standards	EIA-232, CCITT V.24,	EIA-485, CCITT V.11
Baud rate	230,4 kbps	
Transmission type	Asynchronism full duplex, half duplex.	
Optical signalisation	• PWR – green LED power supply, • RX - red LED data receiving from RS485/RS422 interface, • TX - yellow LED data transmission through RS485/RS422 interface.	
Nominal Operating Conditions		
Power requirements	10 - 24 – 30 V DC	
Power Cable	Recommended length of power cable – up to 3m.	
Power	<2W	
Protection from reverse power polarization	YES	
Galvanic Isolation	1kVDC or 3kVDC between power circuit and RS232 and RS485/422 signal line,	
Optoisolation	~3kV - between signal line RS-232 and RS485/422.	
Operating temperature	0 ÷ +23 ÷ 50°C	
Humidity	5 ÷ 95% - non-condensing	
Position during operation	Free	
Mounting	Rail mounting according to DIN35 standard / TS35.	
Electromagnetic compatibility	Resistance to disruptions according to the standard PN-EN 55024. Emission of disruptions according to the standard PN-EN 55022.	
Safety requiring	According to the PN-EN60950 norm.	
Environment	Commercial and light industrial.	
Enclosure		
Dimensions	53 x 90 x 58 mm	
Material	Noryl UL. 94 V-O	
Degree of casing protection	IP40	
Degree of terminal protection	IP20	
Weight	0,10 kg	
According to standard	DIN EN50022, DIN EN43880	
Storage and transportation conditions		
Storage temperature	-40 ÷ +70 °C	
Humidity	5 ÷ 95% - non-condensing	

Dear Customer,

Thank you for purchasing **CEL-MAR Company** products.

We hope that this user manual helped connect and start up the **ADA-1040PC1 converter**. We also wish to inform you that we are a manufacturer of the widest selections of data communications products in the world such as: data transmission converters with interface RS232, RS485, RS422, USB, Current Loop, Fibre-Optic Converters and Ethernet or Wi-Fi.
Please contact us to tell how you like our products and how we can satisfy you present and future expectation.

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